

REMARKS

The Examiner has rejected Claims 1, 26, and 27 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter applicant regards as the invention. Regarding the Examiner's objection to the preambles, such basis of rejection is deemed overcome by virtue of the clarifying amendments made hereinabove.

Further, with respect to the Examiner's other remaining bases for the above rejection, applicant respectfully asserts that limiting applicant to various elements or operations in the absence of limiting prior art would not serve the constitutional purpose of promoting the progress in the useful arts. Therefore, the Examiner is reminded that a rejection based on the grounds that a disclosed critical or essential limitation is missing from a claim should be made only when the language of the specification makes it clear that the limitation is critical for the invention to function as intended. Broad language in the disclosure, including the abstract, omitting an allegedly critical feature, tends to rebut the argument of criticality. See MPEP 2164.08(c).

For example, in the present case, there is no discussion of steps or limitations deemed critical in the specification. Further, it should be noted that there are no such limitations in the Abstract, as filed. See below:

"A system and method are provided for computing partial differential equations in a hardware graphics pipeline. Initially, input is received in a hardware graphics pipeline. Next, the input is processed to generate a solution to a partial differential equation utilizing the hardware graphics pipeline." (see Abstract)

The Examiner has rejected Claims 1-31 under 35 U.S.C. 102(e) as being anticipated by Kaufman et al. (U.S. Pub. No. 2004/0125103). Applicant respectfully disagrees with such rejection.

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With respect to each of the independent claims, the Examiner has relied on the following excerpts from the above reference to make a prior art showing of applicant's claimed generation or computation of "a solution to a partial differential equation utilizing the hardware graphics pipeline" (see this or similar, but not necessarily identical language in each of the independent claims).

"In each iteration, slices perpendicular to the major axis nearest to the random direction  $\sigma$  are processed. Starting with the first slice, a ray front in the form of a 2D buffer is initialized. This buffer is used to transport energy along the rays defined by the elements and  $\sigma$ . At each slice, the rays simultaneously accumulate and deposit energy from the neighboring voxels. The differential equation describing the transfer of energy  $I$  in a ray in direction  $\sigma$  over a differential length  $ds$  is: 1

$$\begin{aligned} dI I_u(s) \varphi(s, \sigma) & \quad \text{if } |\mathbf{L}_p| \cdot \sigma < 0, \\ -I_u(s) - \kappa(s)I(s) & \quad \text{if } |\mathbf{Q}_p| \cdot \sigma = 0, \\ ds - \kappa(s)I(s) \varphi(s, \sigma) & \quad \text{if } |\mathbf{C}_p| \cdot \sigma > 0, \end{aligned}$$

where  $\varphi(s, \sigma)$  is a function describing the tendency of a volume sample to emit or receive energy in the given direction. Fortunately, this equation is easily solved by finite differences, although it could equally well be solved by a finite element method. The gradient-based energy transfer equation is described next."

"To implement SART, a sequence of x-ray images is selected; convergence is faster if successive images are projected in approximately orthogonal directions. A relaxation factor  $\lambda \in [0,1]$  is selected to mix each voxel with its correction. For each image in the sequence, the existing volume (initially empty) is projected from the same viewpoint as the x-ray image. The true image is subtracted from the approximate image and the result scaled by  $\lambda$ . This difference image corresponds to the correction which would fix the volume according to that viewpoint. Rays traverse the volume and deposit the correction value (either positive or negative) to the voxels along the ray. As the process is repeated, the volume converges to the original sampled volume."

Applicant respectfully disagrees with this assertion. Specifically, the above excerpt merely discusses, generally, differential equations, but fails to rise to the level of specificity of applicant's claims. In particular, only applicant teaches and

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claims the generation or computation of "a solution to a partial differential equation utilizing the hardware graphics pipeline" (emphasis added), in the specific context claimed.

Applicant respectfully asserts that it would have been *unobvious* to substitute the ordinary differential equations of Kaufman with the partial differential equations of applicant's claimed invention, since partial differential equations are more difficult to compute. Further, solutions to partial differential equations, in the context claimed by applicant, provide numerous *optional* advantages such as providing for more effective determination of a location of objects or surfaces to be rendered. Note the originally filed specification. Only applicant teaches and claims such a combination of features and component for the generation or computation of partial differential equation solutions.

The Examiner is reminded that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. Of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Moreover, the identical invention must be shown in as complete detail as contained in the claim. *Richardson v. Suzuki Motor Co.* 868 F.2d 1226, 1236, 9USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim.

This criterion has simply not been met by the Kaufman reference, for the reasons set forth hereinabove. A notice of allowance or a specific prior art showing of each of applicant's claimed elements, in combination with the remaining claimed features, is respectfully requested.

Applicant further notes that the prior art is also replete with deficiencies with respect to the dependent claims. For example, with respect to Claims 6-11, the Examiner has generally relied on the teachings of Kaufman to make a prior art showing of applicant's claimed technique "wherein the input includes a local area of textures," "wherein the local area of textures is generated by sampling a texture map," "wherein the local area of textures is filtered," "wherein the local area of

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textures is filtered utilizing a plurality of filters," "wherein the local area of textures is filtered utilizing a filter including a plurality of elements," and "wherein the local area of textures is used to sample a texture map to generate a modified local area of textures," respectively.

Applicant respectfully disagrees with this assertion. The Examiner has simply not made a specific prior art showing of any processing of the foregoing entities for generating "a solution to a partial differential equation utilizing the hardware graphics pipeline," as claimed. A similar rationale applies to Claims 2-5. It is noted that the ordinary differential equations of Kaufman are a function of clearly departed parameters (e.g. length, direction, etc.) for the specific purpose of calculating a transfer of energy.

Still yet, with respect to Claims 13-15, the Examiner has generally relied on the teachings of Kaufman to make a prior art showing of applicant's claimed technique "wherein the relaxation operation is selected based on the partial differential equation," "wherein the processing includes a plurality of iterations of the relaxation operation," and "wherein a number of the iterations of the relaxation operation is reduced using at least one of a prolongation operation and a restriction operation," respectively.

Again, applicant respectfully disagrees with this assertion. The Examiner has simply not made a specific prior art showing of the generation or computation of a partial differential equation solution, and thus inherently has not met any sort of selection of a relaxation operation based on a partial differential equation, nor the remaining limitations highlighted above.

Again, the aforementioned anticipation criterion has simply not been met by the Kaufman reference, for the reasons set forth hereinabove. A notice of allowance or a specific prior art showing of each of applicant's claimed elements, in combination with the remaining claimed features, is respectfully requested.

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Thus, all of the independent claims are deemed allowable. Moreover, the remaining dependent claims are further deemed allowable, in view of their dependence on such independent claims.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 505-5100. If any fees are due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1351 (Order No. NVIDP074\_P000427).

Respectfully submitted,

Kevin J. Zilka

Registration No. 41,429

P.O. Box 721120  
San Jose, CA 95172  
Telephone: (408) 505-5100